

Psychopathology, Social Adjustment and Personality Correlates of Schizotypy Clusters in a Large Nonclinical Sample

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Abstract:

Introduction

Correlational methods, unlike cluster analyses, cannot take into account the possibility that individuals score highly on more than one symptom dimension simultaneously. This may account for some of the inconsistency found in the literature of correlates of schizotypy dimensions. This study explored the clustering of positive and negative schizotypy dimensions in nonclinical subjects and whether schizotypy clusters have meaningful patterns of adjustment in terms of psychopathology, social functioning, and personality.

Methods

Positive and negative schizotypy dimensional scores were derived from the Chapman Psychosis-Prone Scales for 6137 college students and submitted to cluster analysis. Of these, 780 completed the NEO-PI-R and Social Adjustment Scale-self report version, and a further 430 were interviewed for schizophrenia-spectrum, mood, and substance use psychopathology.

Results

Four clusters were obtained: low (nonschizotypic), high positive, high negative, and mixed (high positive and negative) schizotypy. The positive schizotypy cluster presented high rates of psychotic-like experiences, schizotypal and paranoid symptoms, had affective and substance abuse pathology, and was open to experience and extraverted. The negative schizotypy cluster had high rates of negative and schizoid symptoms, impaired social adjustment, high

conscientiousness and low agreeableness. The mixed cluster was the most deviant on almost all aspects.

Conclusions

Our cluster solution is consistent with the limited cluster analytic studies reported in schizotypy and schizophrenia, indicating that meaningful profiles of schizotypy features can be detected in nonclinical populations. The clusters identified displayed a distinct and meaningful pattern of correlates in different domains, thus providing construct validity to the schizotypy types defined.

Keywords: Schizotypy | Schizophrenia | Cluster analysis | Psychopathology | Personality | Social adjustment

Article:

1. Introduction

Factor analytic studies of the symptoms of schizophrenia (Peralta et al., 1992) and schizotypy (Stefanis et al., 2004) support a common underlying structure with at least three dimensions: positive, negative, and disorganized. Alternatively, cluster analysis (Everitt, 1993) can be used to examine whether individuals fall into distinct groups that reflect the dimensions identified by factor analytic studies (Suhr and Spitznagel, 2001a). It can also clarify inconsistencies found in correlational studies that attempt to resolve the heterogeneity of schizophrenia and schizotypy by relating specific symptom dimensions with psychopathology and impairment. Correlational methods do not take into account the possibility that schizotypes are elevated on more than one dimension simultaneously (Walker and Lewine, 1988). Therefore, a study with a predominance of subjects with a pure profile of positive symptoms may find an association between the positive dimension and a given measure; however, this relation may turn out to be weak or nonexistent in another study in which subjects have a mixed profile of high positive *and* negative schizotypy (Suhr and Spitznagel, 2001a). Therefore, cluster analytic studies provide a good complement to factor analytic approaches.

The few cluster analytic studies conducted in schizophrenia indicate that not all patients fit into groups defined by the relatively orthogonal dimensions yielded by factor analytic studies. The consistent picture across schizophrenia studies is that clusters of high positive, high negative, and mixed (high positive and negative) symptoms emerge (Dollfus et al., 1996, Lykouras et al., 2001, Mohr et al., 2004, Morrison et al., 1990 and Williams, 1996), with other clusters depending on the number and nature of dimensions included in the analyses. Similarly, schizotypy studies typically find positive, negative, mixed, and low schizotypy clusters (Aguilera et al., 2008, Barrantes-Vidal et al., 2003, Goulding, 2004, Goulding, 2005 and Loughland and Williams, 1997; Suhr and Spitznagel, 2001a, Suhr and Spitznagel, 2001b and Williams, 1994). The nature of the “mixed cluster” depended on the particular dimensions included in the studies. Suhr and Spitznagel (2001a) used the Schizotypal Personality Questionnaire (SPQ; Raine, 1991), which includes positive, negative and disorganized dimensions, and identified a mixed cluster high on all three dimensions; whereas Barrantes-Vidal et al.

(2003) used the Chapman Psychosis-Proneness scales and found a mixed cluster consisting of positive and negative schizotypy.

A number of studies have examined the correlates of schizotypy dimensions. Dinn et al. (2002) reported differential patterns of correlations of positive and negative schizotypy clusters. Lewandowski et al. (2006) reported that positive, but not negative, schizotypy was related to symptoms of depression and anxiety. Recently, Kwapil et al. (2008) found that both dimensions were related to schizotypal and paranoid personality disorder symptoms, whereas positive schizotypy was uniquely related to psychotic-like experiences, substance abuse, mood disorders, and history of mental health treatment, and negative schizotypy was specifically associated with negative and schizoid symptoms. Both dimensions were associated with poorer overall and social functioning.

However, only two studies have examined behavioral correlates of schizotypy clusters. Suhr and Spitznagel (2001b) reported that participants high on their mixed schizotypy cluster were rated poorer on a behavior rating scale than participants in the positive, negative and low schizotypy clusters. However, as the authors pointed out, the wide range of unusual behaviors were not subdivided into meaningful subscales, rendering it difficult to interpret the findings. Barrantes-Vidal et al. (2003) found that adolescents in the high positive and negative schizotypy cluster received poorer ratings on the Achenbach (1991) Teacher Report Form than in the other clusters. The goal of the present study was to examine the cluster structure of positive and negative schizotypy in a large nonclinically ascertained sample of young adults. We hypothesized that most participants would fall in a low schizotypy cluster, and that the large sample size would allow for the characterization of three distinctive schizotypy clusters: high positive schizotypy, high negative schizotypy, and high positive and negative schizotypy (mixed) clusters. The second aim was to examine the validity of the schizotypy clusters by examining ratings of psychopathology, personality, and impairment. Based on the findings from correlational studies (as no schizotypy cluster study has addressed this issue), we expected that the positive cluster would be associated with schizotypal, paranoid and psychotic-like symptoms, social distress, and mood disorders, as well as high neuroticism and openness to experience. The negative schizotypy cluster was expected to be characterized by schizotypal, schizoid, paranoid, and negative symptoms, social impairment, and low extraversion and openness. Consistent with previous cluster studies, it was expected that the hypothesized mixed schizotypy cluster would exhibit the highest level of symptoms and impairment.

2. Methods

2.1. Subjects

Usable Chapman Psychosis-Proneness questionnaires were completed by 6137 undergraduates enrolled at the University of North Carolina at Greensboro (UNCG) between 1998 and 2005 (this sample and correlational results with these measures were described in Kwapil et al., 2008). The mean age was 19.4 ($SD = 3.7$). Consistent with university demographics, the sample was 76% female and 24% male.

An unselected subset of 780 participants completed questionnaire measures of personality and social functioning. The subsample was comparable to the original sample with 75% female and 25% male and a mean age of 19.3 ($SD = 3.4$). A subset of 430 participants underwent structured diagnostic interviews. Likewise, this subsample was comparable to the original sample with 74% female and 26% male and a mean age of 19.2 ($SD = 1.4$). Participants were recruited for interviews based upon their scores on the Chapman Psychosis-Proneness scales as part of several studies conducted at UNCG. Both subsamples were comparable to the original sample in terms of age and sex. A total of 184 participants were included in both subsamples.

2.2. Materials and procedures

Participants were administered the Magical Ideation (Eckblad and Chapman, 1983), Perceptual Aberration (Chapman et al., 1978), Physical Anhedonia (Chapman et al., 1976), and Revised Social Anhedonia (Eckblad, et al., 1982) Scales. The items were intermixed with a 13-item measure of infrequent responding (Chapman and Chapman, 1983) included to screen out invalid protocols. Participants who endorsed more than two infrequency items were dropped from further study. Participants completed the NEO-PI-R (Costa and McCrae, 1992) and the Social Adjustment Scale (SAS; Weissman, 1999). The NEO-PI-R is a widely used self-report measure of the Five-Factor Model of personality. This model assumes that adaptive and pathological aspects of personality can be accounted for by variation in five basic dimensions: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (each of which are assessed by the questionnaire). The SAS assesses functioning in a variety of social contexts. It provides a total score and three subscale scores applicable to college students that assess social functioning in school, during social and leisure activities, and with family, with higher scores indicating greater impairment.

The interview contained portions of the Structured Clinical Interview for DSM-IV (First et al., 1995) that assesses mood episodes, substance use disorders, and demographic information. Quantitative ratings of substance use and impairment were made using the system described in Kwapil (1996). The modules of the International Personality Disorders Examination (IPDE; World Health Organization, 1995) that assess schizoid, paranoid, and schizotypal personality disorders were included. The IPDE provides personality disorders diagnoses and dimensional ratings.

The Wisconsin Manual for Assessing Psychotic-like Experiences (Chapman and Chapman, 1980 and Kwapil et al., 1999) and the Negative Symptom Manual (Kwapil and Dickerson, in press) were used to quantify psychotic and negative symptoms of schizophrenia across a broad range of clinical and subclinical deviancy. The Global Assessment Scale (GAS; Endicott et al., 1976) was used to assess participants' overall functioning. The interviews were conducted by a licensed clinical psychologist and advanced graduate students in clinical psychology, who were unaware of participants' schizotypy cluster assignment.

3. Results

3.1. Cluster assignment and identification

Aldenderfer and Blashfield (1984) cautioned against including highly correlated scales in cluster analyses and, in such cases, recommended performing principal components analysis to extract underlying dimensions prior to conducting cluster analysis. Given the intercorrelations among the schizotypy scales, we performed a principal components analysis on the four scales using a promax rotation. The analysis produced positive and negative schizotypy factors that accounted for 80% of the variance. Similar to the original schizotypy measures, the distributions of the two component scores were positively skewed. Following Blashfield, we performed square-root transformations to normalize the data. We then performed a *K*-means iterative cluster analysis with the two dimensional scores. *K*-means iterative cluster analyses handle larger data sets better than hierarchical agglomerative methods. Following previous existing cluster studies in schizotypy (Barrantes-Vidal et al., 2003, Loughland and Williams, 1997, Suhr and Spitznagel, 2001a, Suhr and Spitznagel, 2001b, Williams, 1994 and Williams, 1995), we forced a four-cluster solution. We then carried out a MANOVA using the cluster assignment as the independent variable and the schizotypy dimension scores as the dependent variables in order to obtain a discriminative index for the clusters. Wilks' Lambda (0.126) was significant, $p < 0.001$, indicating that with the three canonical functions generated in the analysis only left 13% of the total variance unexplained. Table 1 presents the sample size as well as the means and standard deviations on the positive and negative schizotypy dimensions for each of the four clusters. Given the clear composition of the groupings, we labelled them positive schizotypy, negative schizotypy, mixed schizotypy, and low (or control) schizotypy clusters. Table 1 also presents the cluster characteristics for the interview and questionnaire samples.

Table 1.

Cluster characteristics for the derivation ($n = 6137$), questionnaire ($n = 780$), and interview samples ($n = 430$).

	Cluster				<i>F</i>	Significant comparisons
	Positive schizotypy	Negative schizotypy	Mixed schizotypy	Low schizotypy		
Derivation sample <i>n</i> (%)	1.895(31)	1.352(22)	753(12)	2.137(35)	$df = 3, 6133$	
Positive dimension score	0.80 (0.89)	- 0.60 (0.45)	1.04 (0.78)	- 0.69 (0.42)	2791.7***	M > P > N > L
Negative dimension score	- 0.36 (0.47)	1.03 (0.82)	1.23 (0.68)	- 0.76 (0.44)	3945.8***	M > N > P > L
% Male/female	21.9/78.1	33.7/66.3	30.9/69.1	17.3/82.7	$\chi^2 = 145.91***$	
Questionnaire Sample <i>n</i> (%)	213(27)	169(22)	107(14)	291(37)	$df = 3, 776$	
Positive dimension score	0.82 (0.92)	- 0.57 (0.47)	1.23 (0.90)	- 0.67 (0.43)	357.0***	M > P > N,L
Negative dimension score	- 0.37 (0.48)	1.20 (1.00)	1.28 (0.68)	- 0.81 (0.50)	507.4***	M,N > P > L
% Male/female	22.5/77.5	39.6/60.4	29/71	17.2/82.2	$\chi^2 = 30.29***$	
Interview sample <i>n</i> (%)	124(29)	117(27)	88(20)	101(24)	$df = 3, 426$	
Positive dimension score	1.44 (1.27)	- 0.48 (0.50)	1.52 (0.90)	- 0.69 (0.38)	207.5***	M,P > N,L

	Cluster				<i>F</i>	Significant comparisons
	Positive schizotypy	Negative schizotypy	Mixed schizotypy	Low schizotypy		
Negative dimension score	− 0.44 (0.52)	1.63 (1.04)	1.64 (0.81)	− 0.80 (0.45)	327.5***	M,N > P > L
% Male/female	22.6/77.4	31.6/68.4	22.7/77.3	24.8/75.2	$\chi^2 = 3.24^*$	

*** $p < 0.001$; ** $p < 0.01$ * $p < 0.05$.

Values reflect mean (standard deviation). *Post hoc* comparisons were computed using Newman–Keuls test. Note that cluster assignments were based upon the original derivation sample. The questionnaire and interview subjects are subsets from the original sample using the original cluster assignments. Abbreviations. M: Mixed; P: Positive; N: Negative; L: Low schizotypy.

3.2. Validity of the schizotypy clusters

In order to examine the validity of the schizotypy clusters, a series of one-way ANOVAs was conducted comparing the clusters on interview measures of psychopathology and questionnaire measures of personality and adjustment. Note that MANOVAs were not conducted due to the different predictions for the clusters across measures. *Post hoc* comparisons of the groups were computed using Newman–Keuls test. In the case of categorical data, Fisher's exact test was used to compute the six pairwise comparisons between the clusters. In order to control for Type 1 error, alpha was set at 0.008 (0.05/6).

3.2.1. Relationship with interview measures of psychopathology

Table 2 presents the comparison of the four clusters on interview measures of psychopathology. Table 3 presents the comparison on categorical measures of impairment. As hypothesized, the mixed schizotypy cluster demonstrated the most marked impairment, including deficits in overall functioning and elevated rates of schizotypic symptoms. Predictable patterns of deficits were displayed by the positive and negative clusters. The positive cluster exhibited deficits relative to the negative and control group on psychotic-like experiences, depression, and substance use and abuse. The negative cluster was associated with deficits in schizoid and negative symptoms.

Table 2.

Comparison of the schizotypy clusters on interview measures of psychopathology — quantitative measures (interview sample $n = 430$).

	Cluster				<i>F</i>	Significant comparisons
	Positive schizotypy $n = 124$	Negative schizotypy $n = 117$	Mixed schizotypy $n = 88$	Low schizotypy $n = 101$		
Global adjustment scale	72.7 (9.8)	73.3 (9.2)	67.7 (11.1)	78.5 (7.8)	20.4*** $df = 3, 426$	L > P,N > M
Psychotic-like experiences	1.90 (2.39)	0.72 (1.41)	2.36 (2.51)	0.28 (0.84)	26.5***	M,P > N,L

	Cluster				<i>F</i> <i>df</i> = 3, 426	Significant comparisons
	Positive schizotypy <i>n</i> = 124	Negative schizotypy <i>n</i> = 117	Mixed schizotypy <i>n</i> = 88	Low schizotypy <i>n</i> = 101		
Negative symptoms	1.49 (2.41)	4.70 (5.40)	5.38 (4.93)	0.96 (1.87)	33.3***	M,N > P,L
Schizotypal symptoms	1.40 (1.81)	0.85 (1.32)	2.10 (2.54)	0.27 (0.65)	20.8***	M > P > N > L
Schizoid symptoms	0.30 (0.70)	1.11 (1.86)	1.53 (2.26)	0.15 (0.52)	19.9***	M > N > P,L
Paranoid symptoms	0.81 (1.58)	0.83 (1.55)	1.63 (2.34)	0.19 (0.70)	12.5***	M > P,N > L
Alcohol use	5.31 (6.06)	2.85 (5.08)	3.99 (5.79)	4.04 (5.73)	3.8*	P > N
Alcohol impairment	1.12 (1.01)	0.69 (0.78)	0.88 (0.77)	0.80 (0.74)	5.6**	P > M,N,L
Drug use	3.54 (6.19)	0.75 (2.17)	2.33 (5.14)	1.01 (2.48)	10.1***	P > M > N,L
Drug impairment	0.96 (1.32)	0.29 (0.73)	0.70 (1.18)	0.41 (0.78)	10.0***	P,M > N,L

****p* < .001; ***p* < .01; **p* < .05.

Values reflect mean (standard deviation). *Post hoc* comparisons were computed using Newman–Keuls test. Abbreviations. M: Mixed; P: Positive; N: Negative; L: Low schizotypy.

Table 3.

Comparison of the schizotypy clusters on interview measures of psychopathology — categorical measures (interview sample *n* = 430).

	Cluster				Significant comparisons
	Positive schizotypy <i>n</i> = 124	Negative schizotypy <i>n</i> = 117	Mixed schizotypy <i>n</i> = 88	Low schizotypy <i>n</i> = 101	
Never in a steady relationship	19.4%	32.5%	30.7%	14.9%	N > L
Major depressive episode	28.2%	12.8%	19.3%	12.9%	P > L,N
Manic episode	2.4%	0.0%	3.4%	0.0%	
Psychiatric treatment:					
Hospitalization	4.0%	0.9%	5.7%	1.0%	
Outpatient	27.4%	11.1%	28.4%	15.8%	P,M > N
Medication	11.3%	5.1%	23.9%	10.9%	M > N
1st or 2nd ° relative					
With psychosis	4.0%	5.1%	6.8%	3.0%	
With nonpsychotic illness	58.1%	43.6%	59.1%	48.5%	

Comparisons computed with Fisher's exact test. Alpha = .008.

Abbreviations. M: Mixed; P: Positive; N: Negative; L: Low schizotypy.

3.3. Relationship with questionnaire measures of personality and social functioning

Table 4 presents the comparison of the four clusters on the SAS and the NEO-PI-R. The mixed cluster demonstrated the greatest impairment in social functioning. Both the positive and negative clusters exhibited impairment relative to the control group; however, the negative cluster's impairment was limited to social and leisure settings. Positive schizotypy was associated with increased Neuroticism and decreased Agreeableness and Conscientiousness. Negative schizotypy was associated with lower Extraversion, Openness, and Agreeableness relative to the low cluster. In general, the mixed cluster exhibited the most extreme scores on the Five-Factor domains. The exception was that the mixed cluster was intermediate to the positive and negative clusters on Openness, consistent with the notion that positive and negative schizotypy are best differentiated by this domain.

Table 4.

Comparison of the schizotypy clusters on questionnaire measures of personality and social adjustment (questionnaire sample $n = 780$).

	Cluster				<i>F</i> <i>df</i> = 3, 776	Significant comparisons
	Positive schizotypy <i>n</i> = 213	Negative schizotypy <i>n</i> = 169	Mixed schizotypy <i>n</i> = 107	Low schizotypy <i>n</i> = 291		
<i>Social adjustment scale</i> ^a						
Total	1.93 (0.31)	1.89 (0.33)	2.11 (0.41)	1.77 (0.30)	31.0***	M > P,N > L
Student	1.92 (0.50)	1.74 (0.44)	2.01 (0.80)	1.72 (0.44)	12.2***	M,P > N,L
Leisure	2.00 (0.42)	2.11 (0.52)	2.25 (0.50)	1.88 (0.43)	19.6***	M > N > P > L
Family	1.83 (0.46)	1.76 (0.47)	2.07 (0.67)	1.66 (0.43)	18.9***	M > P,N,L; P > L
<i>NEO-PI-R (T scores)</i>						
Neuroticism	59.1 (9.1)	54.0 (10.4)	62.3 (10.7)	53.1 (9.1)	33.4***	M > P > L,N
Extraversion	57.0 (10.1)	49.2 (11.0)	46.2 (11.4)	59.4 (9.4)	64.8***	L > P > N > M
Openness to Experience	57.7 (11.1)	46.8 (9.8)	53.6 (11.6)	55.9 (10.1)	37.9***	P,L > M > N
Agreeableness	40.7 (12.8)	41.5 (11.6)	38.6 (13.0)	46.6 (10.9)	17.0***	L > P,M,N
Conscientiousness	39.5 (10.9)	43.5 (10.3)	39.6 (12.1)	43.3 (11.2)	7.7***	N,L > M,P

*** $p < .001$; ** $p < .01$; * $p < .05$.

Abbreviations. M: Mixed; P: Positive; N: Negative; L: Low schizotypy.

Please note that higher scores reflect worse adjustment on the Social Adjustment Scale.

§

Values reflect mean (standard deviation). *Post hoc* comparisons were computed using Newman–Keuls test.

4. Discussion

4.1. Schizotypy clusters

To our knowledge, this study employed the largest sample of nonclinically ascertained subjects to explore schizotypy clusters, yielding four clusters characterized by low, high positive, high negative, and mixed (high positive and negative) schizotypy. This cluster assignment was consistent with the findings from the limited cluster studies of schizotypic and schizophrenic symptoms (e.g., Barrantes-Vidal et al., 2003, Williams, 1994, Van der Does et al., 1993 and Williams, 1996). Suhr and Spitznagel, 2001a and Suhr and Spitznagel, 2001b found two different cluster solutions in studies of college students. Using an unselected sample they found clusters defined primarily by the level of symptom intensity (low, average, high, and a positive/disorganized cluster); whereas when using a subsample of high schizotypy scorers, they found that clusters were defined by the predominance of specific schizotypy features (positive, negative, mixed, and low), not by intensity levels. The difference between their study and the present one is that they used the SPQ in the cluster analysis with an unselected sample. It might be argued that the measurement of positive schizotypy is highly comparable in both studies despite the use of different questionnaires. However, the present study also includes an assessment of the negative symptom dimension. As the SPQ was developed to measure schizotypal personality disorder, which largely lacks anhedonia (a notable feature of negative schizotypy), this measure may not have adequately captured negative symptom traits. Additionally, the lack of clusters defined by the positive and negative schizotypy dimensions in the Suhr and Spitznagel (2001a) unselected sample may indicate that trait-oriented scales are better able to capture meaningful variation in a nonclinical population than symptom-oriented scales.

4.2. Validation of clusters: psychopathology, social adjustment and personality

The positive and negative schizotypy clusters in the present study were associated with hypothesized patterns of symptoms and impairment, supporting the validity of the clusters. In terms of schizophrenia-spectrum psychopathology, the positive schizotypy cluster was characterized by elevated interview-based ratings of psychotic-like, schizotypal, and paranoid symptoms compared to the low schizotypy cluster. Conversely, the negative schizotypy cluster was associated with interview ratings of negative and schizoid symptoms, as well as paranoid and schizotypal symptoms. This pattern of relationships lends further support to the construct validity of positive and negative schizotypy as tapped by psychometric inventories in nonclinical samples. Additionally, the mixed schizotypy cluster had the most deviant ratings on all these indices, suggesting that the combination of high positive and negative schizotypic traits is especially impairing.

The positive, but not negative, schizotypy cluster was characterized by heightened substance use and impairment, history of major depressive episodes and outpatient psychiatric treatment, as well as impaired social adjustment. Positive schizotypy was also associated with impairment in scholastic activities and interactions. This is striking because the participants were all students and the findings indicated that positive schizotypes experienced impairment in a primary area of functioning. The mean five-factor personality scores for the positive schizotypy cluster were generally within the average range. However, the positive schizotypy cluster members generally reported more neuroticism, extraversion, and openness than the remaining schizotypic clusters

participants, and less agreeableness and conscientiousness than the low schizotypy cluster members. This profile is consistent with previous findings reporting higher impulsivity (Dinn et al., 2002) and drug consumption (Kwapil, 1996) associated with positive schizotypy, and also with the personality profile of higher openness and extraversion than negative schizotypy (Kwapil et al., 2008). The positive schizotypy cluster members also reported elevated history of major depressive episodes, consistent with a number of previous studies. Using confirmatory factor analysis, Lewandowski et al. (2006) reported an association between positive schizotypy and mood symptoms in nonclinical subjects. Varghese et al. (2009) found that odds of endorsing any psychotic-like symptoms increased in community individuals with lifetime history of major depressive or anxiety disorder. Likewise, longitudinal studies found that positive schizotypy (Chapman et al., 1994) and psychotic-like experiences (Verdoux et al., 1999) were associated with elevated rates of mood disorders (at ten-year and one-year reassessments, respectively). Interestingly, Van Rossum et al. (2009) described that the temporal persistence and clinical relevance of psychotic experiences were progressively more likely with greater level of affective symptoms. The relation of positive schizotypy and mood symptoms is consistent with findings from behavioral genetics studies indicating an increased rate of mood disorders in relatives of schizophrenia patients (e.g., Baron and Gruen, 1991). These findings suggested that there may be shared genetic and environmental risk factors for psychosis and depression, with differences being quantitative rather than qualitative for mood and non-mood psychoses (van Os et al., 1998), consistent with the *einheitspsychosis* or unitary psychosis concept that affective and non-affective psychoses lie on a continuum (Crow, 1995).

In addition to schizoid symptoms, the negative schizotypy cluster was, as expected, characterized by social disconnection and impairment. Participants in the negative schizotypy cluster were less likely than those in the low schizotypy cluster to have ever been in a steady romantic relationship and they reported poorer social adjustment (especially in voluntary social activities such as spending time with friends and dating). In terms of personality, this cluster displayed decreased extraversion, Agreeableness, and Openness to Experience, consistent with the descriptions by Costa and Widiger (1994).

4.3. What is mixed schizotypy?

An advantage of examining schizotypy clusters instead of dimensions is that it allows us to classify participants who present with both positive and negative schizotypy simultaneously. Studies using dimensional scores on positive and negative schizotypy often address this issue by analyzing the schizotypy interaction term; however, this is not the same as defining a cluster of individuals with a mixed profile. Indeed, the findings in the present paper show that the mixed cluster was not only the most deviant group, but that they differed on certain aspects from the pure positive and negative clusters. However, previous analyses using dimensional scores for positive and negative schizotypy from these subjects found that the interaction term was not significant for any of the dependent measures (Kwapil et al., 2008). These contrasting findings from the same data suggest that the effects of positive and negative schizotypy are additive.

The positive and negative schizotypy dimensions have been hypothesized to have independent heritability and distinct pathophysiologies (e.g., Siever, 1995). Nevertheless, the present study

indicates that these dimensions can co-occur, and that their coexistence is associated with a broader range of symptoms and more severe presentation than either dimension individually. This fits with the notion that certain combinations of behavior may have a different meaning compared to the same behaviors considered in isolation (Rutter, 1996). Furthermore, these findings are consistent with the results of Chapman et al.'s (1994) ten-year longitudinal study of schizotypic and control participants. They reported that participants identified by positive schizotypy (perceptual aberration and magical ideation) had higher rates of psychosis (5%) than did control participants (1%) and, interestingly, participants who were identified by both positive (magical ideation) and negative (social anhedonia) schizotypy had a 21% rate of psychosis at the reassessment. The authors offered two interpretations for these findings. On the one hand, the heightened rates of psychosis in this group might be due to the fact that social anhedonia might prevent high positive schizotypy subjects from obtaining emotional support and treatment. On the other hand, a syndrome of traits may be a more powerful predictor than a single trait. The present findings provided additional support for the validity of psychometric screening inventories for assessing schizotypy in nonclinical samples previously demonstrated in other samples (e.g., Chapman et al., 1994, Gooding et al., 2005 and Kwapil, 1998). The identification of nonpsychotic schizotypes is essential for understanding the etiology and development of schizophrenia and spectrum disorders. Longitudinal study should examine whether the mixed schizotypy cluster is at especially heightened risk for transitioning into clinical disorders.

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Contributors

Neus Barrantes-Vidal, PhD, wrote parts of the manuscript and helped in the design of data analysis. Kathryn E. Lewandowski, PhD, oversaw the implementation of the study, contributed to the data management and data analysis; Thomas R. Kwapil, PhD, designed the study, provided supervision in the implementation of the study, conducted the statistical analyses, and contributed to the writing of the manuscript.

Conflict of interest

None of the authors had a conflict of interest.

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